Title: Management of LOI through Fuel Selection using EPRI's NOxLOI Predictor Version II.

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Summary

The NO_xLOI PREDICTOR is a software package designed to predict the effect of coal switching on NOx and fly ash carbon in full-scale utility operation. The LOI algorithm is based on fundamental char burnout kinetics developed under DOE funding (CBK model) coupled with a simplified furnace model that is calibrated with a single data point for the baseline unit operation. The code is microcomputer based and computationally efficient, allowing rapid screening of a list of candidate coals as an aid in fuel purchasing decisions. The requires only readily available fuel analyses (proximate and ultimate) and a minimum of technical data on the unit.

Version 1 of the code was developed in 1997 and has been validated against combustion data on laboratory, pilot, and full-scale units. The algorithm has been used to predict the relative burnout of a suite of international coals burned under identical conditions in a drop tube furnace, using only proximate and ultimate analysis of the fuels as input data. The algorithm has also been used to predict burnout and LOI for a suite of international coals burned in a 12-MW pilot rig at the utility PowerGen. Finally, the code has been used in a significant number of utility test cases in which LOI values were measured before and after coal switching. Version 1 is currently installed at a number of U.S. utilities. Version 2, which is now in alpha test phase, includes expanded capabilities for coal blends and for cofiring applications involving petroleum coke or wood-based fuels. Version 2 has a professional graphical user interface, and supports a variety of forms of data input, including the use of international units of measure.

This paper will describe the technical basis for the LOI Predictions in Version 2, will give a summary of field experience, and will highlight the way the code can be used in practice to manage LOI problems. The code is well suited for examining the effects of (a) coal switching, (b) coal blending, (c) coal/alternate fuel cofiring, (d) changes in grinding practice. Version 2 includes a mechanistic model of the simultaneous combustion of multiple blend components (coal or alternate fuels), including interactive effects such as the degradation of burnout of one component due to rapid oxygen depletion by a second, high-volatile component. Detailed parameter studies with the code have shown that no single coal or unit variable governs LOI — it is a complex function of the fuel (ash content, char reactivity, volatile content under flame conditions), grinding practice (size distribution, especially from 50 - 300 μm), and unit design and operation. The NOxLOI Predictor is not designed to predict the effects of changes in boiler operation, but is a focused tool for quantifying the trade off between competing effects of different fuel properties (particle size, coal type, ash content, volatile matter) on LOI.